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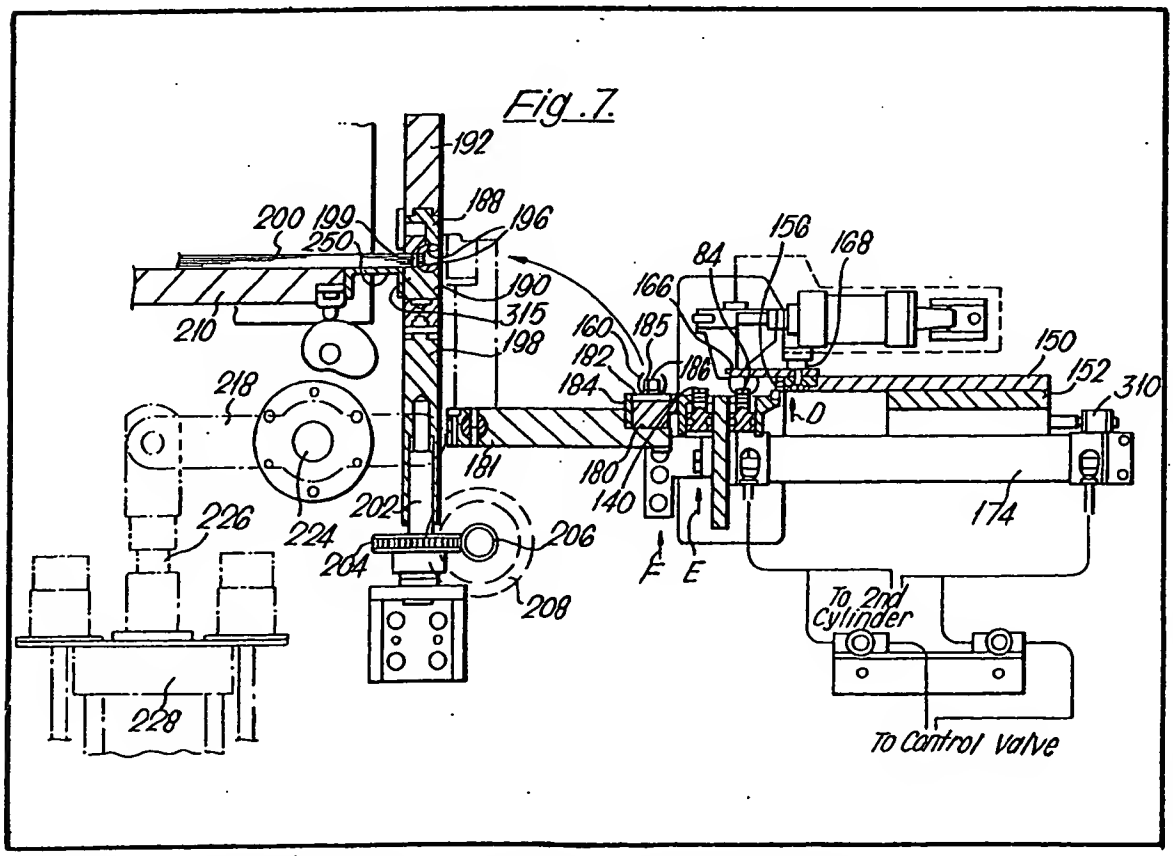
(54) Wire binding machines

(57) A wire binding machine for accepting and closing wire-O-type binding wire (10) to bind a stack (200) of sheets together in which the machine is enabled to accept a plurality of differently pitched and diametered wire sizes by means of an adaptable input feed means [80, 82], feed conveyor (84), translating means (150, 180) and closing means (192, 198).



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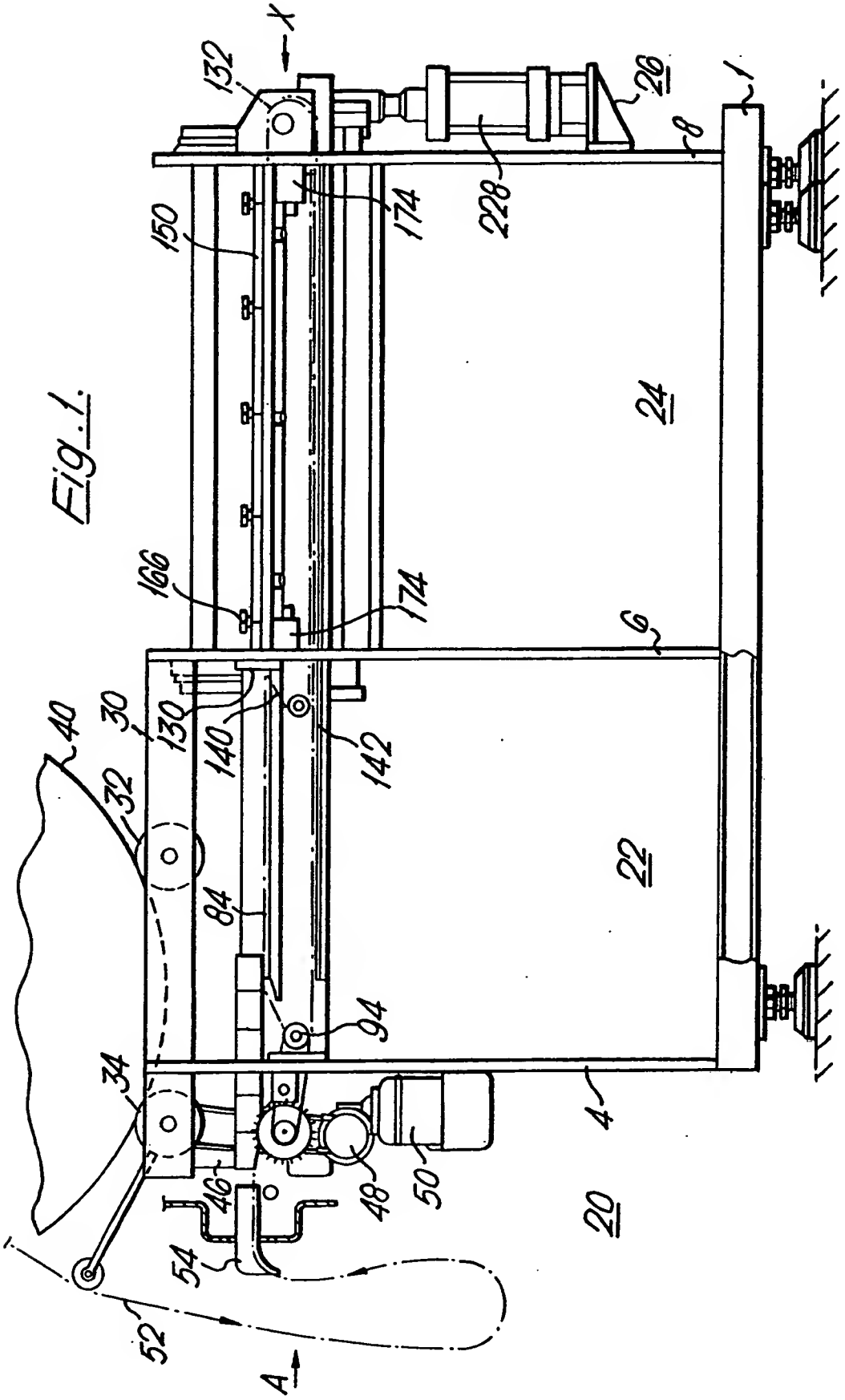

Fig.1.

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Fig.2.

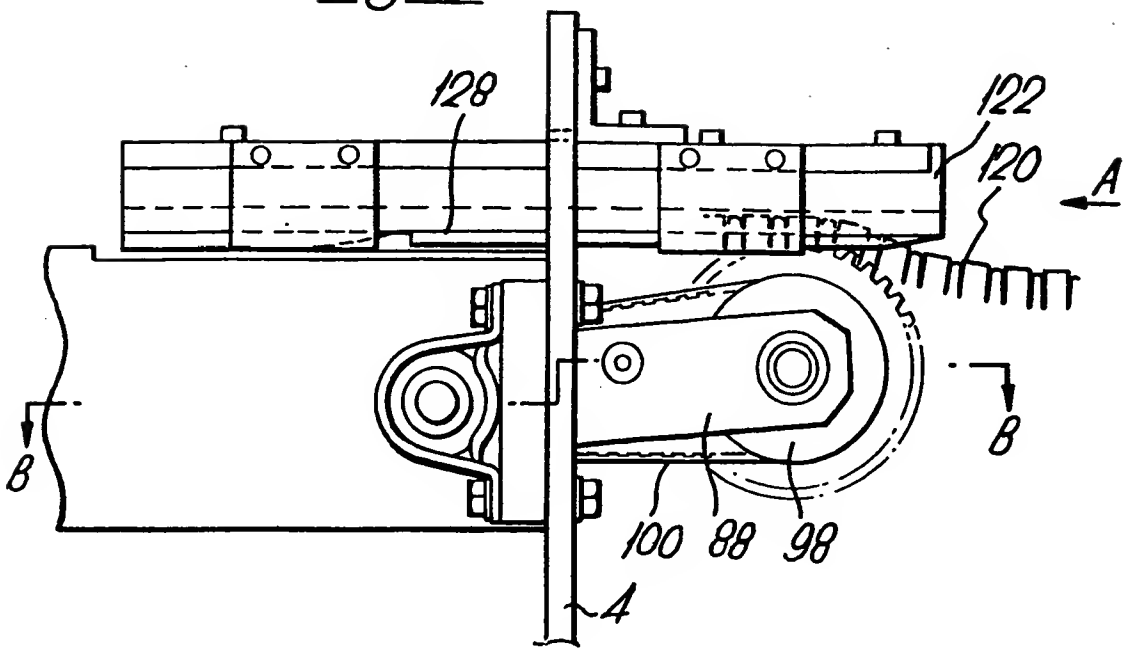

Fig.3.

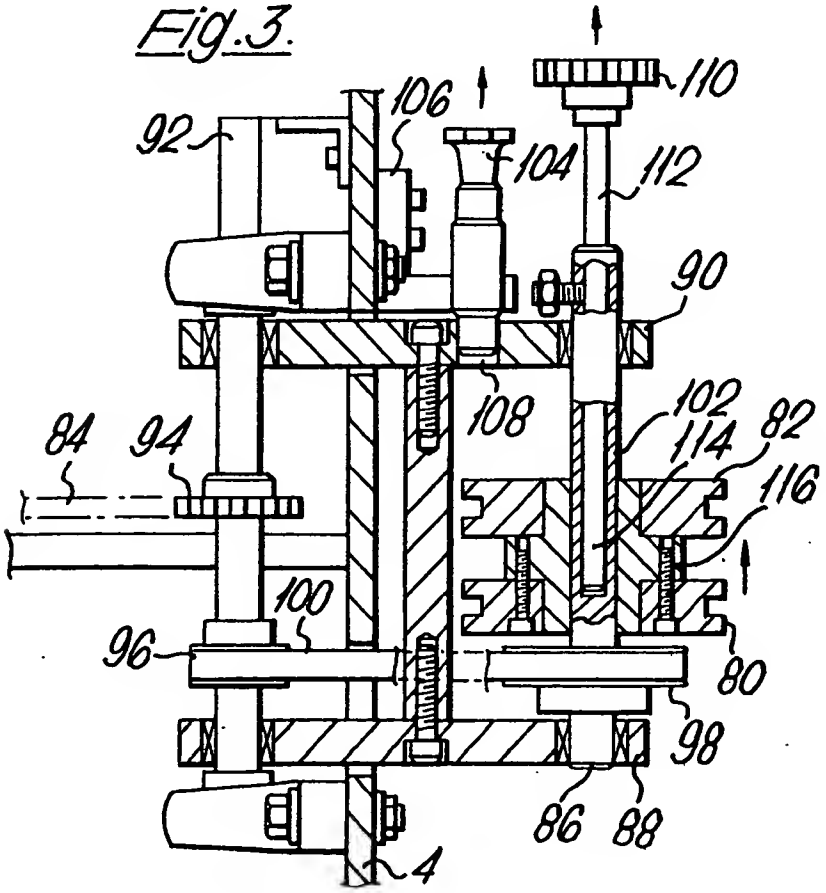

Fig.4.

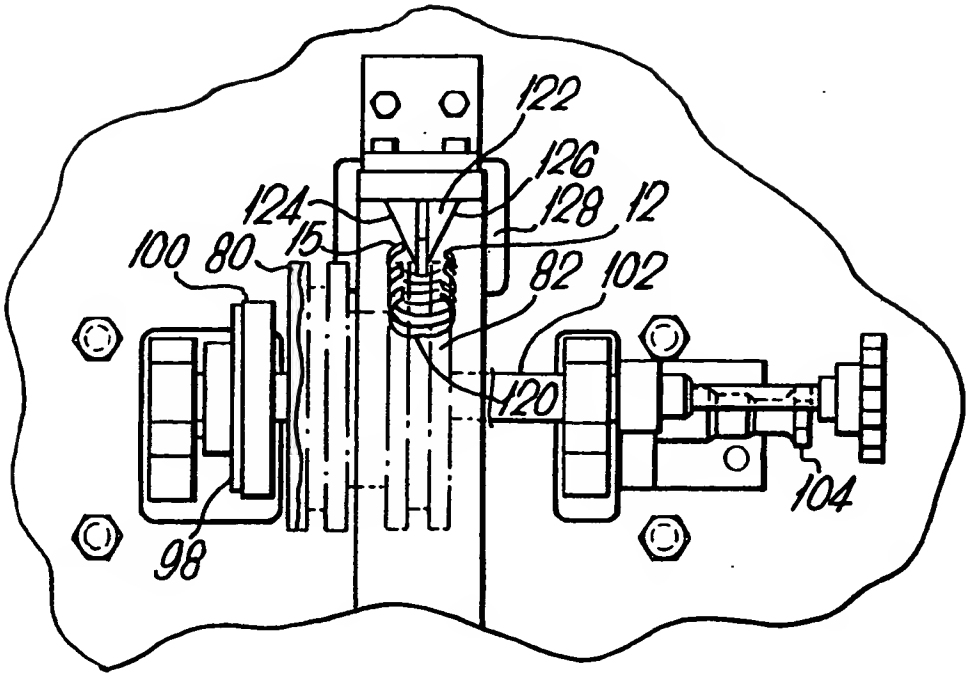

Fig.5.

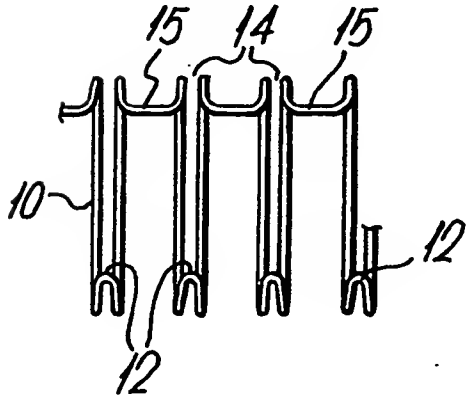

Fig.6.

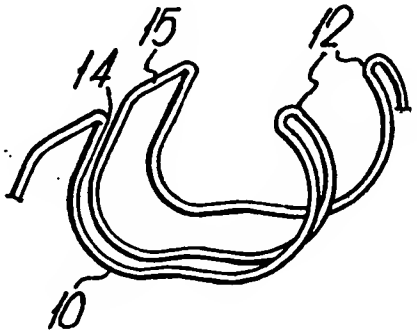

Fig. 7A.

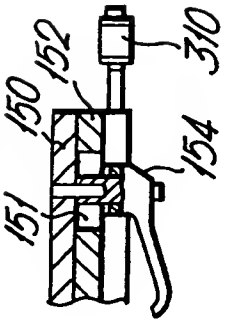
151
150
152
154
310

Fig. 7.

310
152
150
174
168
156
84
166
185
186
D
E
F
To control valve
To 2nd cylinder
160
182
184
180
140
206
208
181
192
188
196
190
315
198
199
250
200
210
202
204
224
218
226
228

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Fig. 8.

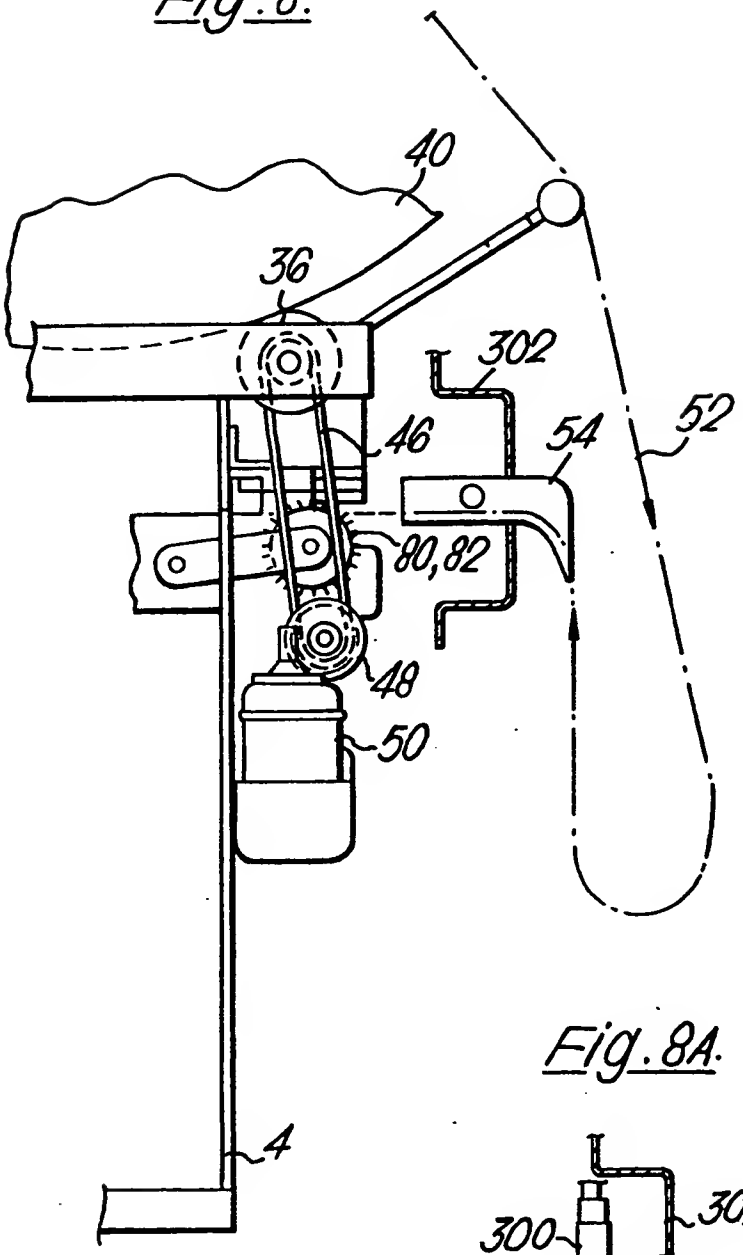


Fig. 8A.

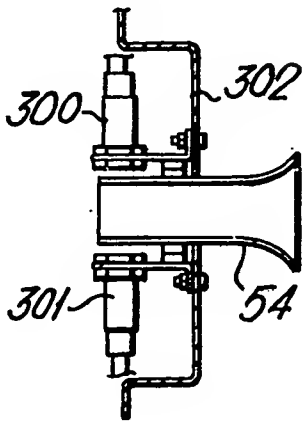
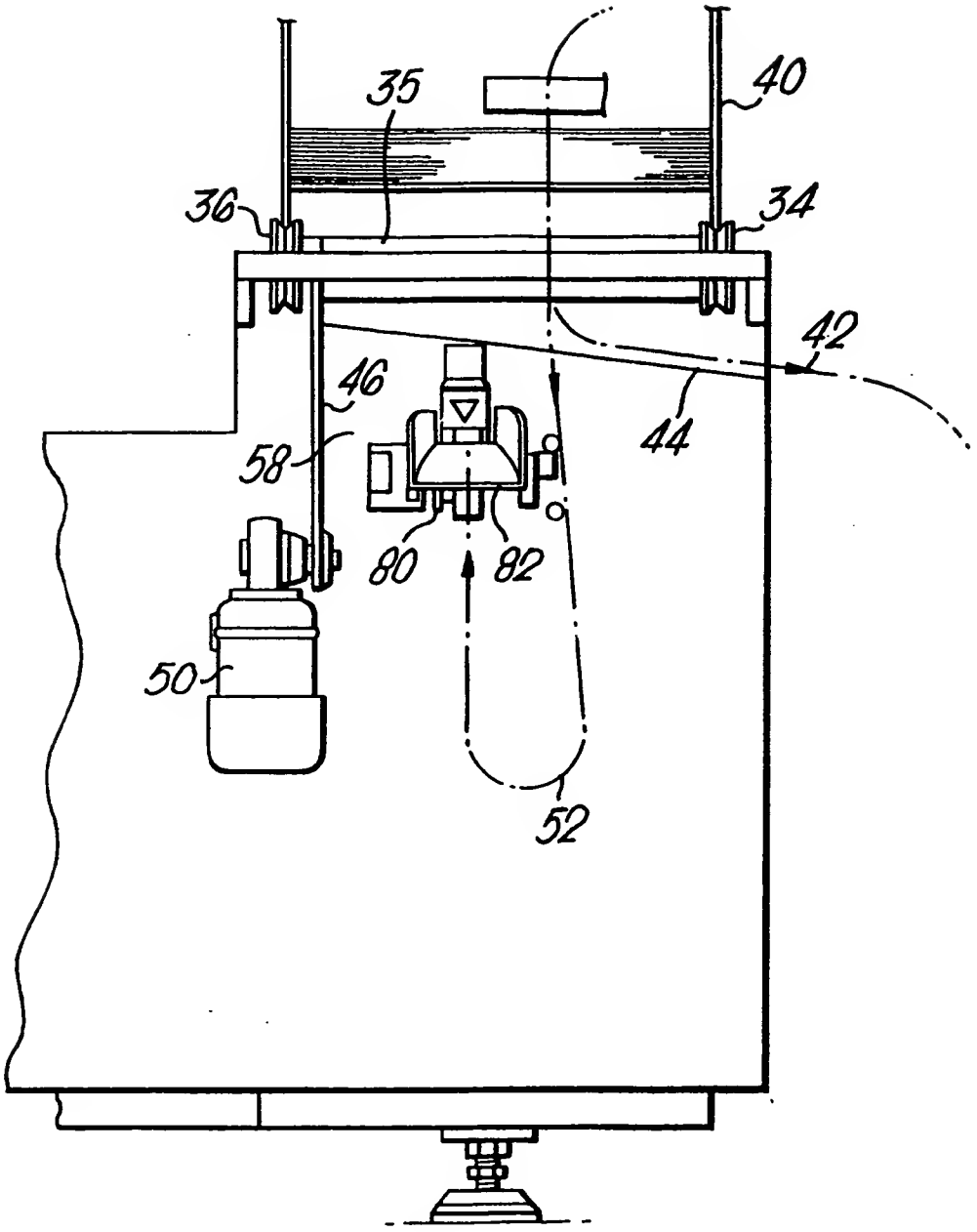


Fig.9.



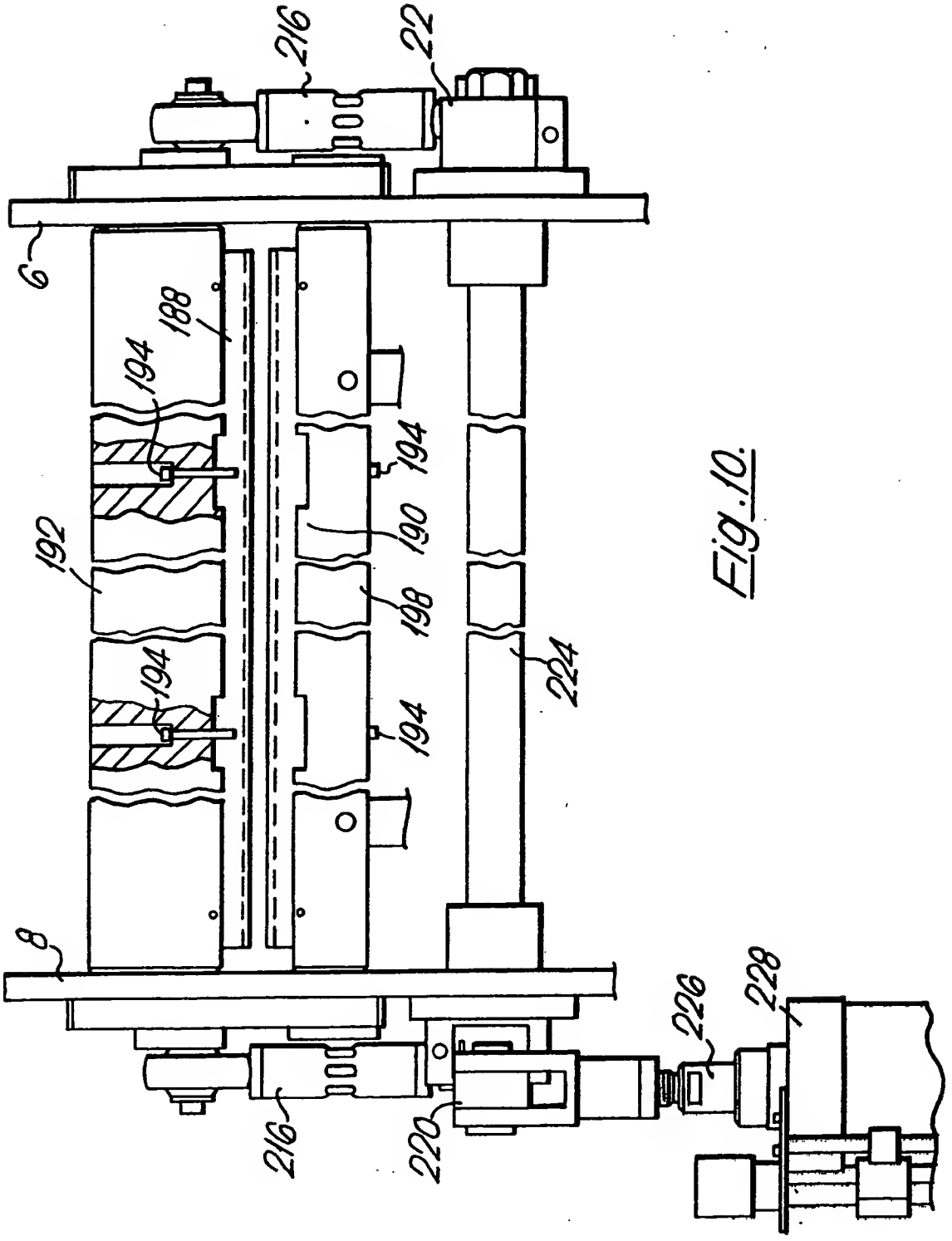


Fig.10.

Fig. 11.

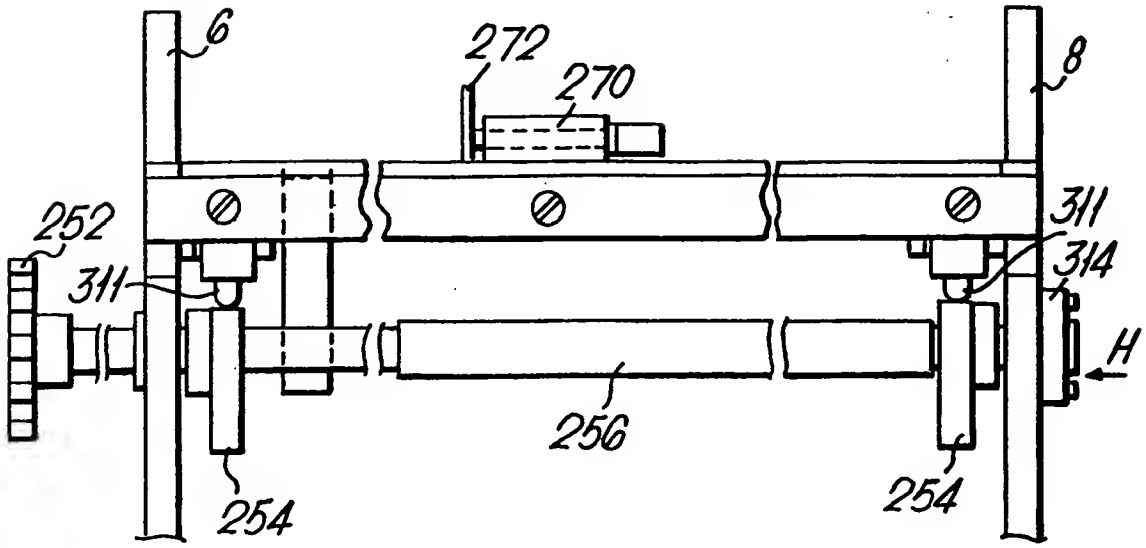


Fig. 12.

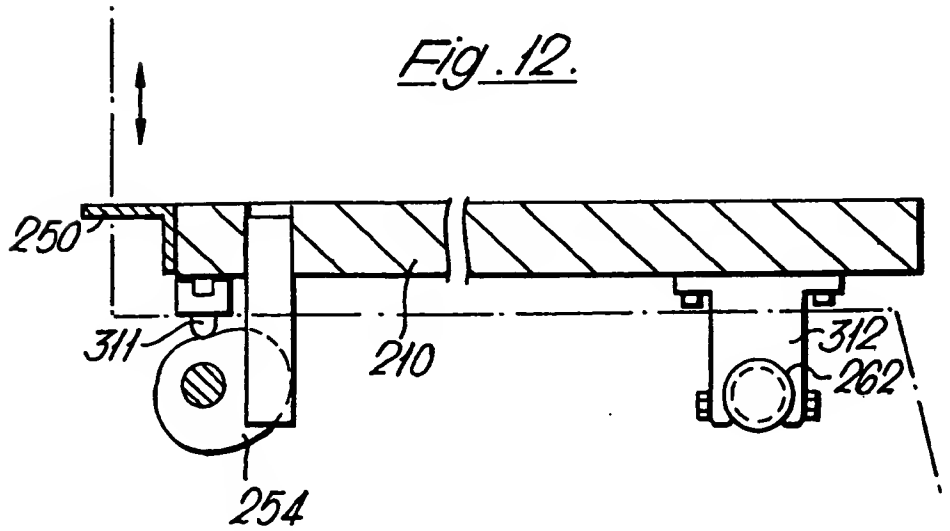


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Fig. 13.

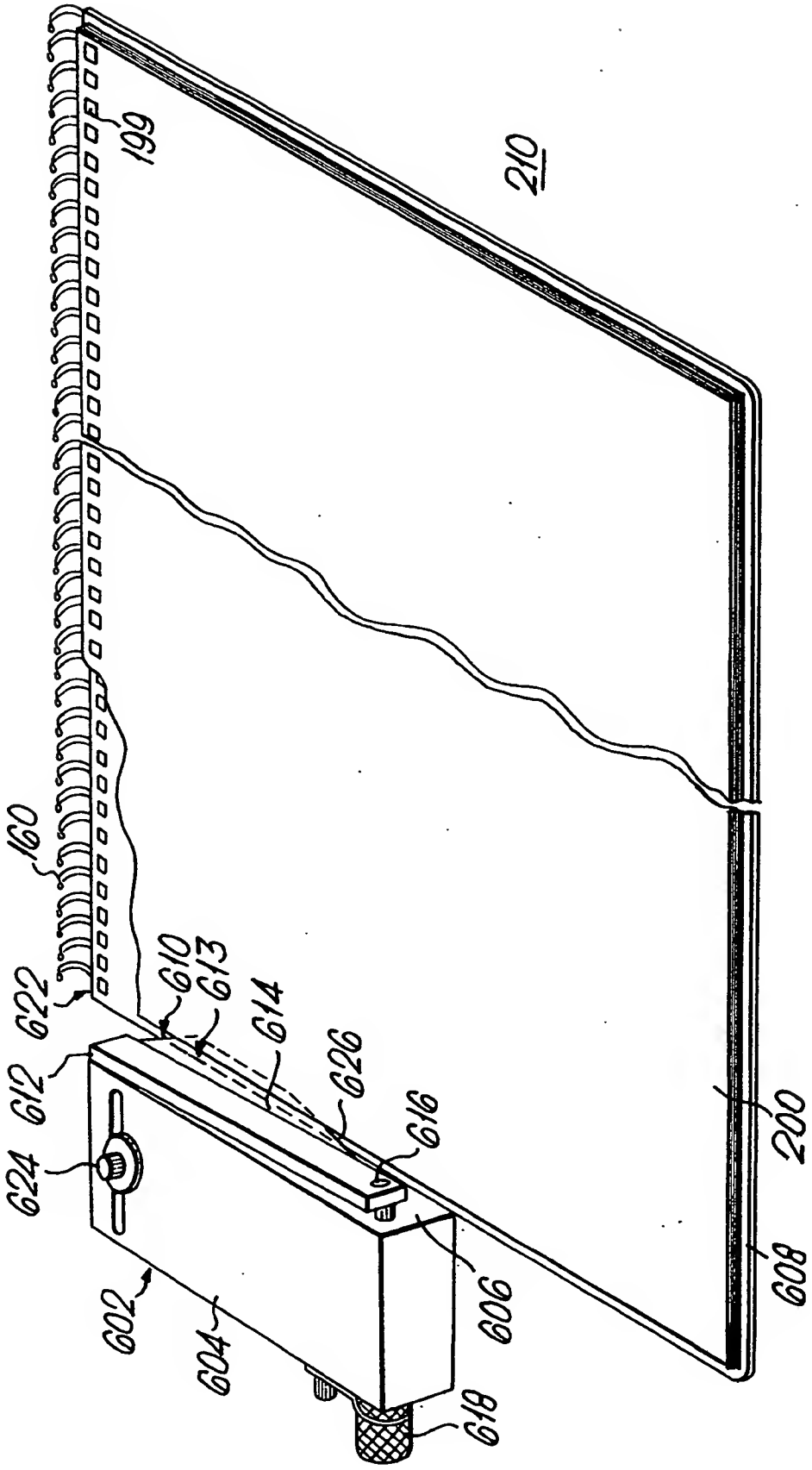


Fig.14.

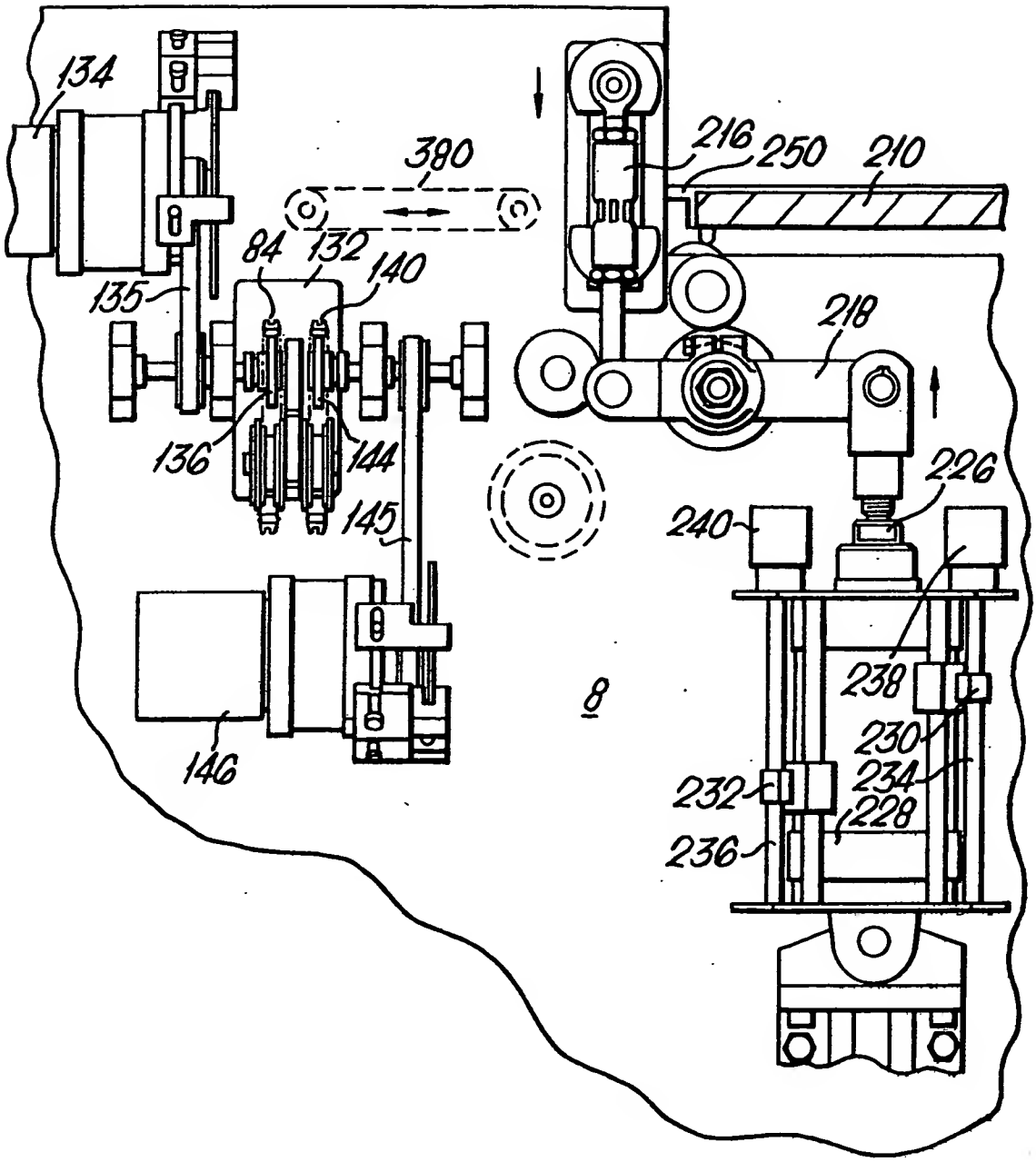
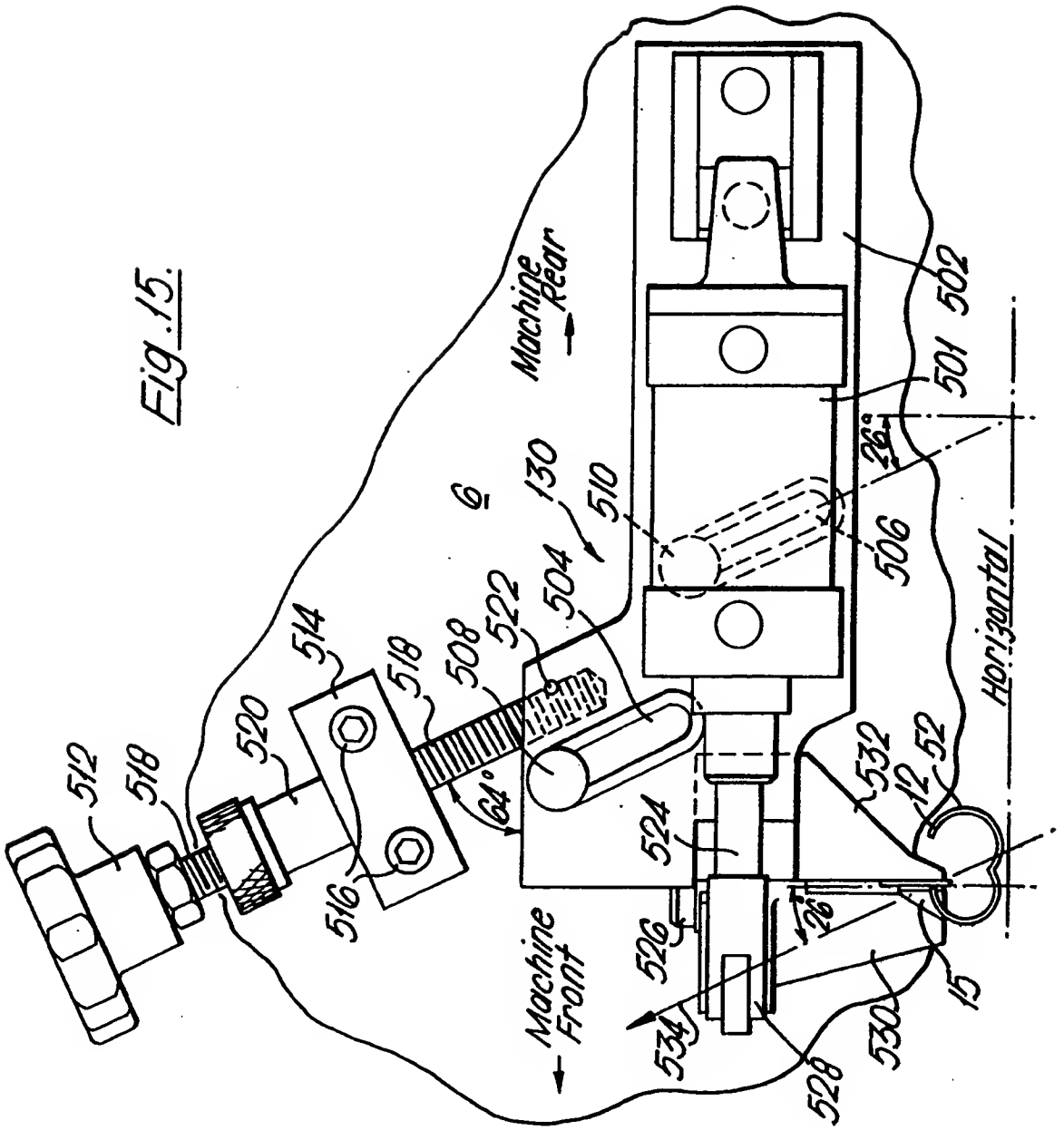

134
380
216
250
210
84
132
140
135
218
136
144
226
145
240
8
238
230
234
232
228
236
146

Fig. 15.


Machine Rear
Machine Front
Horizontal
6
130
510
504
522
508
518
514
520
512
516
524
526
528
530
532
534
501
502
506
64°
26°
12
15

SPECIFICATION

Improvements in and relating to wire binding machines

The present invention relates to wire binding machines for closing wire binding elements to bind bundles of sheets. It is particularly applicable to those machines which use binding which are each formed from a length of metal wire bent to form a series of curved hairpin-shaped prongs on which sheets are impaled and which are brought to ring shape by pressing their closed ends or "points" into the vicinity of their open ends or "roots". Such binding elements will be referred to herein as "Wire-O" (Registered Trade Mark) binding elements.

Binding machines of the kind described above will be referred to herein as "machines of the kind set forth".

"Wire-O" binding elements as shown in Figures 5 and 6 of the present application are supplied to machines of the kind set forth from spools in the form of a long continuous "strip" in a so called "open" condition, the end view being as shown in Figure 6. The "strip" is then cut into lengths referred to as "elements" and the "points" shown at 12 in Fig. 5 are formed by a closing device of the machine into the "closed" position so that the end view is approximately circular of a predetermined "diameter" with the "points" formed into the "roots" shown at 14. Wire portions between the roots as shown at 15 will be referred to as "blunts". The distance between the "points" will be referred to as the "pitch" of the strips. The bundles of sheets to be bound whether in substantially book pad or like form or variations thereof will be generally referred to as "bundles" or stacks.

The guidance of "strips" in machines of the kind set forth has to be carefully controlled and therefore it has been generally the case that such machines are designed for a particular "pitch" and "diameter" of wire "strip". Due to the increasing use of "Wire-O" binding elements, binders have found it necessary to increasingly vary the "pitch" and "diameter" which has not been possible with known such machines.

A machine of the kind set forth according to the present invention comprises input feed means arranged to accept binding strip, a feed device arranged to feed the "strip" from the input feed means, a cutting means enabled to cut the "strip" into binding elements of predetermined length and fed by the feed device, a closing means at a closing station arranged to be fed with the elements, means for translating the elements either singly or in plurality from the feed device to the closing means and a bundle feed table for supporting a bundle at the closing station wherein the input feed means, feed device, translating means and closing means are adapted to accept binding "strip" and binding "elements" of predetermined and variable pitch and/or predetermined and variable diameter.

Preferably the input means is arranged to be driven at the same linear speed as the feed device and may be provided with strip engaging toothed feed wheels, each having a tooth pitch differing one from the other, means being provided to shift a required wheel in alignment with the feed device. In one preferred embodiment only two wheels are provided, the differing toothed pitches enabling engagement with a wide range of differently pitched strip.

Preferably the feed device comprises a main conveyor having a plurality of strip engaging members. The conveyor is preferably a chain with the strip engaging members formed as notched teeth located between the chain links. The conveyor preferably extends between the input feed means to and beyond the translating means. Allowance for a wide range of differently pitched strip is achieved by the strip engaging with different surfaces of the notched teeth. Allowance for a wide range of differently diametered strip is achieved by means of a wedge shaped guide adjecent and parallel the conveyor, the points and blunts of the strip being guided by either side of the guide surfaces.

In order to allow for calendar binding a skip conveyor running parallel to the main conveyor may be provided at the closing station, the translating means being arranged to translate a first binding element from the main conveyor to the skip conveyor and a second binding element from the main conveyor to the skip conveyor with a longitudinal gap between the elements.

Preferably the translating means is provided with adjustment for different diametered elements. The adjustment may comprise stroke adjustment and/or an adjustable guide adjecent and parallel the main conveyor, the guide acting approximately on the points and blunts of the elements to locate each element on the main conveyor, the adjustable guide being adjustable for separation distance from the main conveyor.

Preferably the closing means is adjustable for relative stroke to allow for different element diameters, closing means comprising a bottom adjustable height tool holder and a top tool holder; the tool holders may have replaceable forming tools to allow for different diameters and/or pitches of the elements.

Preferably the cutting tool is adjustable in a direction 26° to the vertical to allow for variations in diameter of the strip. Variations in pitch of the strip may be allowed for by adjustment in the position where the feed device stops. The cutting tool is preferably arranged to cut the "blunts" of the strip and one jaw is located above the main conveyor whilst the other jaw is located to the front of that conveyor.

Preferably the bundle feed table is adjustable for height relative the closed position of the closing means so that a perforated bundle on the table locates with the perforations aligned with the points on the binding element when this is held by the transfer bar between upper and lower closing jaws of the closing means.

An embodiment of the invention will now be

described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a rear view of a binding machine according to the present invention,

Fig. 2 is a front view of an input means of the machine of Fig. 1,

Fig. 3 is a cross-sectional top view of the input means of Fig. 2 taken a long B—B,

Fig. 4 is a side view of the input means of Fig. 2 seen from A,

Fig. 5 is a top view of part of a Wire 'O' binding strip for use in the machine of Fig. 1,

Fig. 6 is an end view of the strip of Fig. 5,

Fig. 7 is a side view of translating means, and closing means as seen from A,

Fig. 7A is a side view of an edjustment device for the translating means of Fig. 7,

Fig. 8 is a front view of the input means and spool take off of the machine of Fig. 1,

Fig. 8A is e plen view showing proximity switches forming part of a wire feed device on the right hand of Fig. 8,

Fig. 9 is a side view from A of the input means and spool take off of Fig. 8,

Fig. 10 is a front view of the closing means of the machine of Fig. 1,

Fig. 11 is a rear view of a feed table of the machine of Fig. 1,

Fig. 12 is a cross section taken on C—C of Fig. 11 showing table elevating arrangements,

Fig. 13 is a perspective view of an over size cover gauging device on the table of Fig. 12,

Fig. 14 is a partial end view of the machine of Fig. 1 seen from X showing the closing means operating mechanism and conveyor drives, and

Fig. 15 is a side view of a cutter for the machine of Fig. 1.

In the example of the machine shown in the drawings as shown in Figure 1 which shows the rear of the machine the frame 1 supports sub frames 4, 6 and 8 which extend from front to rear. The section 20 of the machine frame 4 will be referred to as the input feed section; section 22 between frames 4 and 6 will be referred to as the main feed section; section 24 between frames 6 and 8 will be referred to as the binding section; and section 26 outside frame 8 on the end of the machine as seen from X will be referred to as the mechanism section.

In the feed section which is on the right of machine as seen from the front is a spool frame 30 on which are four rollers 32, 34, 36 and 38 (not shown). Rollers 36 and 34 have a rubber roller 35 of coarse textured rubber between them (see Fig. 9). The rubber roller acts to strip a paper web 42 from between layers of binding wire strip on the spool 40. The web 42 feeds over the rubber roller under the spool and is ejected down a chute 44 (see Fig. 9) to the rear of the machine.

Rollers 36 and 34 are driven by a belt 46 through a gear box 48 and by a motor 50. The motor drive is controlled via a clutch device so as to rotate the spool when receiving a signal from one of the proximity switches (300 and 301). The other switches the machine off if the wire tangles on the spool or becomes jammed in the main feed.

Before describing these arrangements it will be appreciated that the machine is arranged to handle twelve or more different sizes of binding wire, these are in one machine:—

	Diameter	*Pitch*
1	inch (25.4 mm)	2 to 1 inch (25.4 mm)
3/4	inch (19 mm)	2 to 1 inch (25.4 mm)
5/8	inch (16 mm)	2 to 1 Inch (25.4 mm)
9/16	inch (14 mm)	3 to 1 inch (25.4 mm)
1/2	inch (12.7 mm)	3 to 1 inch (25.4 mm)
7/16	inch (11 mm)	3 to 1 inch (25.4 mm)
3/8	Inch (9.5 mm)	3 to 1 Inch (25.4 mm)
5/16	inch (8 mm)	3 to 1 inch (25.4 mm)
1/4	inch (6.4 mm)	3 to 1 inch (25.4 mm)
3/16	inch (4.7 mm)	3 to 1 inch (25.4 mm)
1/4	inch (6.4 mm)	4 to 1 inch (25.4 mm)
3/16	inch (4.7 mm)	4 to 1 Inch (25.4 mm)

The diameter has already been referred to as the "closed" diameter and the pitch is the distance between adjacent "points" 12 (see Figs. 5 and 6). Pitch will be referred to as 2:1, 3:1 and 4:1 hereafter, omitting the linear units. Diameter will be referred to hereafter using the above fractions of an inch without the units.

When using a selected diameter Wire-O strip, this strip shown at 52 comes off the spool onto a pivotally mounted horizontal tray 54 plvoted on to the end cover 302: after passing over the tray the slack in the strip is controlled by proximity swltches 300 and 301 which sense the angle deflection of the wire feed tray 54.

In the event of failure of supply of Wire-O from the spool the feed tray will deflect to its maximum limit triggering the appropriate proximity sensor resulting in the machine being switched off automatically.

After passing over the tray 54 the strip is then fed to one of two feed sprocket wheels 80, 82 one being for 2:1 and 4:1 pitch and the other for 3:1 pitch (see Fig. 3) the sprocket wheels 80 or 82 are aligned with a maln feed chain shown in Fig. 3 as e broken line 84 extending from the feed section 22 through binding section 24 to mechanism sectlon 26.

Sprocket wheels 80 and 82 are mounted with their axis 86 in brackets 88 and 90 which are pivotally mounted on shaft 92 which carries an idling main drive sprocket wheel 94 and belt drive pulley wheel 96, wheels 94 and 96 are both fixed to shaft 92 so that when the main drive conveyor chain 84 is driven wheel 96 drives a wheel 98 through belt 100 and wheel 98 fixed to shaft 102 drives wheels 80 and 82.

Brackets 88 and 90 are held in an upper position (Fig. 2) by means of a spring loaded plunger 104 mounted on bracket 106 bolted to frame 4, the plunger engaging in a hole 108 in bracket 90. Also on bracket 90 is a knob 110 on shaft 112 which within hollow shaft 102 has a pin 114 which engages with block 116 on which wheels 80 and 82 are mounted.

To shift wheel 80 into alignment with drive chain 84, plunger 104 is pulled, brackets 88 and 90 drops disengaging wheel 82 from the binding wire strip now indicated at 120, knob 110 is pulled moving wheel 80 into allgnment with chain 84. The brackets are then pushed upwards engaging wheel 80 with the strip 120 and the plunger 104 is re-engaged to hold brackets up.

It will be appreciated thet the drive arrangements to the wheels 80 and 82 are so arranged that the same lineer feed speed is maintained between the chain 84 and wheels 80 and 82 which form a part of an input feed means.

Located above the sprocket 82 (see Fig. 4) or alternatively above sprocket 80 whichever is aligned with chain 84 is a "V" shaped guide 122 whose sloping sides 124 and 126 act to guide the blunts 15 and points 12 of the strip 120 respectively, the points being to the rear of the machine. A central guide filler 128 et the apex of sides 124 and 126 acts to press the connecting portions 10 of the strip (see Figs. 5 end 6) onto wheels 80, 82 and thereefter the strip onto the main drive chain 84. The guide 122 can also be formed as in our copending British Patent Application No. 8111808 filed 14th April 1981, the contents of which are incorporated herein by reference.

The drive chain 84 forming a part of a feed device feeds strip 120 from the input feed means to a cutting means 130 not shown in detail but located in the frame 6 between sections 22 and 24. The drive chain 84 is a link chain forming a main conveyor which has e plurality of strip engaging members formed as plastics cruciform notched chein inserts which are shown in detail with the chain in our co-pending British Patent Application No. 8111808 filed 14th April 1981. The form of the notches allows for differently pitched strip to be firmly engaged whatever the pitch.

The cutting means 130 is a knife and anvil, the knife being adjustable from top of the mechine to ensure that it chops the strip on e blunt portion, adjustment being necessary when the diameter is changed.

The chain 84 extends through section 24 to a chain drive unit 132 mounted in section 26 on frame 8, the unit 132 includes a high capacity main chain drive 1.8° stepper motor 134 driving through a belt 135 a drive sprocket wheel 136 (see Fig. 14).

Running parallel to chain 84 is a skip conveyor chain 140 similarly provided with notched chain inserts whose upper conveying surface is level with the upper conveying surface of chain 84. Chain 140 extends across section 24 and between an idling sprocket wheel 142 (Fig. 1) and a drive sprocket wheel 144 (Fig. 14) driven through a belt 145 by a single 1.8° stepper motor 146 of smaller capacity than motor 134 in unit 132. Motor 146 is of a smaller capacity because chain 140 is shorter than chain 84. The skip conveyor function will be described hereafter.

Adjacent frame 6 is a stepper motor control module (not shown) which controls the predetermined indexing of the stepper motors according to a programme selected on a control panel mounted on the right hand end as seen from the rear (not shown). The cutter and the transfer of wire from chain 84 to chain 140 by e pusher mechanism forming part of a transleting means are controlled entirely by the stepper motor control module.

To the rear of the main chain in section 24 and extending from side to side of the section is the pusher mechanism comprising a pusher bar 150 (see Figs. 1 and 7) mounted adjustably on a block 152, the adjustment being relative the block and from front to rear. Adjustment between block and bar is by means of a slot 151 in block 152, lock knobs 154 and fine adjustment screws 310 one eech of which is shown in Fig. 7A. The bar 150 has an element pushing surface 156 which engages against the points side of a binding element one of which is shown at 160 which hes been cut from strip 120. Mounted on pusher bar 150 is a packer member 156 (changed for each wire diameter) from which extends an acrylic edjustable guide plate 166 held on by handwheels 168 so that the guide is just clear of the top of an element 160 as it sits on the chain 84. Depending on the wire diameter this guide 166 is adjusted up or down relative chain 84 by providing a packer 156 of a differing height.

The pusher bar 150 and mounting block 152 are mounted on piston mountings of a pair of rodless magnetic cylinders 174, one at each end coupled to frame 6 and frame 8. These pneumatic cylinders have 3 magnetic reed switches to enable the pusher assembly to be moved between three positions; namely, a first position D es shown in Fig. 7 with pusher assembly retracted, a second position E, with pusher assembly moved halfway forward (used when using skip binding facility) and a third position F when pusher assembly is fully forward. In the first position the pusher bar rests against binding elements 160 on the main chain. In the second position the pusher bar moves the element 160 onto the skip chain. In the third position the pusher bar moves the element 160 to a transfer bar 180.

Transfer bar 180 is pivotally mounted on a shaft 181 and movable from the horizontal position shown in Fig. 7 to an upper vertical position where it can hold an element 160 between upper and lower closing jaws 188 and 190. On the upper surface of transfer bar 180 relative its horizontal position is a plastics carrier member 182 retained onto the bar 180 by a dovetail recess in the bar and a dovetail locating plate 184. The member 182 is formed with groups of about five teeth 185 extending up from the bar 180 to about the same level as the top of the chain notched inserts and between each group a higher tooth 186 about twice the height of group teeth 185 is provided. These higher teeth 185 act as book stops in a similar way to the book stops described in our copending British Patent Application No. 8111828 filed 14 April 1981.

The member 182 however holds the elements 160 by the resilience of its material suitably high density polythene. The member 182 must be changed for each pitch and diameter used in the machine since the lateral distance between teeth 185 is relative the pitch and the book stop higher teeth 185 have a height depended on element diameter.

Pivotal control of the transfer bar 180 Is by means of a pneumatic actuator (not shown) connected to shaft 182. The pusher bar mechanism and transfer bar arrangement form parts of translating means for translating the elements either singly or In plurality from the feed device conveyor to the closing means of which the closing jaws are a part.

The closing jaws 188 and 190 are separately movable but when closing they hold, then form the wire element into perforations 199 in a bundle 200 on a feed table 210, only the top jaw 188 moving. Top jaw or tool 188 is mounted In a top tool holder 192 and can be removed therefrom by unscrewing retaining screws 194 (see Fig. 10). The lower surface of jaw 188 is curved to the diameter of the element and projections 196 locating between the wire points extend from the curved surface a distance corresponding to the wire gauge. The separation of projections 196 is dependent on wire pitch, for this reason if pitch or diameter of wire is to be changed the top tool must be changed.

The bottom tool 190 is mounted in a bottom tool holder 198 to which it is retained by further retaining scews 194. This tool also has a curve forming surface to the diameter of the element and projections 196 locating between the wire points extend from the curved surface a distance corresponding to the wire geuge. The separations of projections 196 is dependent on wire pitch, for this reason if pitch or diameter of wire is to be changed, the bottom tool must also be changed.

Bottom tool 190 is adjustable for height by means of a pair of screw jacks drivable via worm wheels 204 and worms 206 from a motor 208 controlled from the control panel.

The top tool 188 is movable by means of a cylinder 228 through a pair of adjustable turnbuckles 216 attached to top tool holder 192 and to a rocker arm 218 on one side and an arm 222 on the other side (see Fig. 10). Rocker arm 218 and arm 222 are linked by a rod 224, a piston rod 226 connecting arm 218 to a piston (not shown) in cylinder 228. Cylinder 228 is pneumatically operated and has a magnetized piston (not shown). Reed switches 230 and 232 are mounted on screws 234 and 236 each driven by a respective motor 238 and 240. The stroke of the piston is adjusted between 3 positions, that is firstly piston down-upper tool fully up, secondly upper tool partially down—binding element held between jaws, and thirdly upper tool down—jaws closed. The second and third positions are those which have to be adjusted for different wire diameter and these positions are controlled by location of the reed switches 230 and 232 respectively relative to the cylinder. To change the second and third positions the motors 238 and 240 are switched on and the reed switches moved to a new predetermined position as more particularly described in coterminous Patent Application No. (claiming priority from British Patent Application No. 8214894 of 21st May 1982) incorporated herein by reference.

In order to ensure the bundle to be bound is In the correct position for binding relative a particular diameter of binding element, the table 210 is adjustable for height. The table has a projecting rear lip 250 the rear upper edge of which must be level with the blunt portions of the wire elements. The gap between lip 250 and bottom tool 190 Is taken up by a filler plate 315 (see Fig. 7).

To adjust the table a simple elevating device is shown in Figs. 11 and 12 comprising a knob 252 accessible from the side of the machine, a pair of cams 254 mounted on shaft 256 supporting two buttons 311 fixed to the underside of the table. The front of the table has two brackets 312 with half round slots supported on two pivot bars 262 attached to frames 6 and 8. The buttons 311 are always in contact with cams 254. By turning handwheel 252 clockwise the table can be raised to required height. The handwheel can be rotated clockwise only. This is achieved by a freewheel assembly 314 mounted on cam shaft 256 and attached to frame 8. The table assembly 210, 270, 272 can be easily removed off the machine by simply lifting it up and off the pivot bars 262. This is necessary when the machine is linked to an autofeed system for pre-punched stock.

On top of the table 210 is a lay gauge 270 with an adjustable guide fence 272, the gauge being locatable In any one of a number of positions on the table. The gauge Is used for aligning bundles. Also on the top of the table is a pneumatic detector 274 which detects the presence or lack of presence of a bundle on the table and with a suitable interlock circuit prevents a further element being presented to the closing jaws before the bound bundle or book is withdrawn form the table. The pneumatic detector can be replaced by an electronic or other suitable detector.

The cutting means 130 comprises a cylinder 501 mounted to a block 502. The block has a pair of angled slots 504, 506 through which headed pins 508 and 510 pass to secure the block slidably to frame 6 of the machine. An adjustment knob 512 with an externally threaded stem 518 screws in and out of internally threaded collar 520 is mounted to block 514; screws 514, 516 secure block 514 to frame 6. The end of stem 518 is held rotatably to block 502 by pin 522 so that by turning knob 512 block 502 can be moved at an angle of 26° to the vertical relative frame 6.

A piston rod 524 of cylinder 501 acts on yoke 528 to move a knife 530 about pivot 526 so as to cut the wire 52 on an anvil 532 (the knife 530 and anvil 532 forming cutter jaws). The anvil is

located immediately above feed conveyor 84 whilst the knife is towards the front of the machine. The knife and anvil together act to cut the wire strip 52 at a "broad" 15, that is on the side of the strip opposite the "points" 12. In order to allow for different diameters of wire 52 the anvil and knife are adjusted along the line 534 by means of knob 512. The angle of 26° to the vertical which is the inclination of line 534 has been found to cover all diameters of wire previously. Clearly this angle can be made subject to a slight variation, for example it may be between 20° and 30°.

The control interlocks and sequencing arrangements for the machine are obtained by mean of latching and de-latching electrical relays, controlled by cascaded electrical limit switches.

To change the machine from one diameter binding element to another the following adjustments are made:

(i) Release knob 154 and adjust pusher bar stroke with screws 310.

(ii) Adjust guide height with handwheels 168 and by introducing a correct size pusher 156.

(iii) Change tools 188 and 190.

(iv) Change transfer bar member 182.

(v) Reposition bottom tool holder 140 for correct height by means of a bottom tool up switch or down switch on the control panel.

(vi) Adjust top tool stroke by activating motors 240 and 238.

(vii) Change spool 40.

(ix) Introduce strip feed lead in the form of a dancing loop on tray 54 and into wire feed switch and onto the main conveyor.

(x) Reposition cutter assembly 130 by means of knob 512.

To change the machine from one pitch of binding element to another the following adjustments are made:

(i) Change position of wheels 80, 82 if required.

(ii) Change top tool 188.

(iii) Change bottom tool 190.

(iv) Change transfer bar member 182.

The overall rather than detailed difference between the present machine and prior machines is that the present machine is designed to be easily adaptable to handle a large number of different sizes and pitches of binding wire; furthermore the provision of right to left feed of the binding wire ensures that the points are to the rear of the machine prior to location between the jaws. This ensures that the points are pressed downwards into the bundle so that when bundles are fed front uppermost onto the table the junction between points and roots is at the back of the bundle which is most desirable for a clean binding appearance. Previously bundles had to be placed front downwards on the table. The closing of points downwardly ensures that oversize covers can be bound, the back cover being placed on the front cover and swung to the back after completion of binding. The oversize cover can be oversize on all sides except the binding side, that is on three sides.

Arrangements for skip binding are described more particularly in copending Application No. 8310503 (claiming priority from British Patent Application No. 8214896 filed 21st May 1982) incorporated herein by reference.

Other arrangements for the machine described herein are described more particularly in copending Applications Nos. 8310504 and (claiming priority from British Patent Applications Nos. 8214893 and 8214894, both filed 21st May 1982) incorporated herein by reference.

For oversize binding a special lay-gauge 602 shown in Fig. 13 is provided. This has a vertical locating face 606 for locating a pair of oversize covers 608 placed on the loner side of stack 200. A stop arm 610 comprising a weighting bar 612 and fin 613 is pivotted to body 604 by pin 616. Fin 613 has its gauging face 614 engaging with stack 200, which face is parallel to face 606. The distance between the parallel faces 606 and 614 governs the amount of oversize overlap between the covers and stack and this is adjusted by means of a screw 618 which joins with pin 616.

Claims

1. A wire binding machine for closing wire binding elements to bind together a plurality of sheets forming a stack into books, pads, calendars or the like, the sheets being perforated, the elements being formed from a predetermined length of a strip of wire preformed to have a series of "points" of narrow width adapted to be inserted in the perforations and joined by root portions of the wire of a normally wider width than the "points" so as to form "blunts", the machine comprising input feed means arranged to accept said binding strip, a feed conveyor arranged to feed the strip from the feed means to a cutting means enabled to cut the strip into binding elements of the predetermined length and fed by the feed means from the cutting means of a closing means at a closing station, means for translating the elements from the feed conveyor to the closing means and a stack feed means on the front of the machine for supporting a stack at the closing station wherein the input feed means, the feed conveyor, the translating means and closing means are adapted to accept binding "strip" and bind elements of predetermined and variable pitch and/or predetermined and variable diameter.

2. A machine as claimed in claim 1 wherein the input means is arranged to be driven at the same linear speed as the feed conveyor, the input means being desirably engaged to the strip by means of one of a plurality, and preferably only two, strips engaging toothed coaxial feed wheels, each wheel having a tooth pitch differing one from the other, means being provided to shift a required wheel into alignment with the feed conveyor.

3. A machine as claimed in claim 1 or claim 2

wherein the feed conveyor is an endless chain with strip engaging members formed as notched teeth locating between the chain links, the teeth engaging between portions of the strip between the "points" and "blunts" and wherein a wedge shaped guide is located above one of the wheels and over a part of the feed conveyor to press the strip onto the wheel and feed conveyor and wherein the points and blunts are guided by side surfaces and by the guide.

4. A machine as claimed in any one of claims 1 to 3 wherein the cutting means comprises a pair of jaws, preferably a knife and anvil one of which is actuated by an actuator and mounted to a frame, the frame being adjustable in a direction 20° to 30° and preferably 26° to the vertical sloping toward the machine's front, one of the jaws being immediately above the feed conveyor.

5. A machine as claimed in claim 4 wherein the jaws are operable to cut the strip at one of the "blunts" to cut the strip into the elements of a predetermined length set by a variable control on the machine.

6. A machine as claimed in any one of claims 1 to 5 wherein a spacing or skip conveyor is arranged to run parallel to the feed conveyor, and wherein a part of the translating means is arranged to push elements from the feed conveyor to the spacing conveyor at variable intervals to obtain a variable distance between the elements.

7. A machine as claimed in any one of claims 1 to 6 wherein a part of the translating means comprises a pivotal arm with a detachable carrier toothed member thereon, the teeth having every fifth or so tooth being a higher than the other teeth, the higher teeth acting to locate the stack when the element or elements are located between the closing means.

8. A machine as claimed in any one of claims 1 to 7 wherein the stroke of the closing means is adjustable by means of an operable control engaging with a lower tool holder of the closing means.

9. A machine as claimed in any one of claims 1 to 8 wherein the closing means comprises upper and lower tool holders, a range of removable tools attachable and detachable to and from the tool holders to allow for different diameters and/or pitches of the elements.

10. A machine as claimed in any one of claims 1 to 9 wherein a stack to be bound is located for height adjacent the closing means by stack feed means, preferably a table, the height of the stack feed means being adjustable for height by suitable means.

11. A wire binding machine for closing wire-O-type binding elements to bind together a plurality of sheets substantially as described with reference to any one of Figures 1 to 4 and 7 to 15.

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